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The Habits and Control of White Grubs
in Manitoba

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OTTAWA

THE HABITS AND CONTROL OF WHITE GRUBS IN MANITOBA

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WHILE White Grubs have never been a very serious pest in the Prairie Provinces, they are, nevertheless, at times of considerable economic importance as destroyers of growing grain, grasses, and certain kinds of truck crops. The June beetles, the adults of the white grubs, attack the foliage of many trees and shrubs, at times effecting much injury. As the beetles feed upon the leaves of trees, they are, in consequence, restricted in their feeding areas to situations from which they can easily gain access to their food plants, consequently, we do not find them on the treeless plains.

Four different species of White Grubs are at present known to occur within the province of Manitoba, namely, *Lachnosterna anxia* Le Conte (= *dubia* Sm.), *L. nitida* Le Conte, *L. drakii* Kirby (= *grandis* Sm.), and *L. rugosa* Melsh.

DISTRIBUTION AND ENVIRONMENT

Lachnosterna anxia Le Conte. This species is an inhabitant of either rich soils or lowlands, and, therefore, most frequently met with along the river flats or in the vicinity of moist willow-inhabiting areas. It has a wide range in these situations, and extends in the West from the eastern border of Manitoba to the Pacific.

L. nitida Le Conte. In Manitoba this species is frequently found in company with the last, but has a greater preference for woodlands and a drier condition of soil. The adults seldom leave the open groves in which they breed, and thus, while numerous, are easily overlooked.

L. drakii Kirby. An inhabitant of

sandy soils in the vicinity of open woods; larvæ are often found among the roots of low bushes such as wild cherry, thorn, etc., and in dry valleys. It is quite abundant in its chosen haunts, which frequently overlap those of *L. rugosa*.

L. rugosa Melsh. Like *L. drakii*, this species inhabits sandy soils, and the only difference in its choice of locality is that it prefers higher and more open situations for breeding purposes.

LIFE HISTORY SUMMER HABITS

All the above species have in the province of Manitoba a four-year life-cycle, of which the egg stage occupies about one month, the larval life three years, the pupal condition one month, and the beetle eleven months. Since, however, all eggs are not laid at the same time, and pupæ may be met with from the end of June until the middle of September, these stages collectively cover considerably longer periods.

L. anxia Le Conte. Adults emerge during the middle of May, their time of appearance being apparently governed by factors which also influence the leafing of trees. Thus, we can reasonably expect to meet with the adults of this species at the time when willows and aspen poplars are beginning to burst their buds. While, however, the beetles appear in late May, they do not attain their greatest activities until June, when most of the eggs are laid. But few adults survive beyond the middle of August. The eggs are deposited singly in small cavities prepared by the female beetle; surrounding these are little balls of earth, also constructed by

the beetle, upon which, there is every reason to believe, the small grubs feed. The egg itself is at first cylindrical, but later becomes almost round by expansion. Eggs are generally found to a depth of one to four inches, a few being deposited each day, the entire period of egg-laying extending over several weeks.

After eating its way through the earthen chamber, the small larva lives chiefly upon decayed vegetation for the first season. The second summer is also one of comparatively small economic importance, and it is only when the grubs become very numerous that they are appreciably destructive. Thus, the third season's growth is under way before the insect acquires the reputation of being a pest. It has now, however, reached a stage when living roots are sought in preference to decayed matter, with the result that many kinds of crops may suffer. The destructive tendencies increase as the larvæ develop, and reach their greatest magnitude in June at the end of the third year, a week or two before pupation. When about to pupate the grub constructs a large chamber close to where it has been feeding. It then gradually becomes motionless and assumes a soft, watery condition, yellow in colour. The grub now gradually shortens, and in due course transforms into a true pupa. The prepupal yellow stage commences about June 26th; pupæ are present early in July, and beetles have developed from them by the middle of that month. Adults usually remain in the pupal chamber until about to emerge the following spring.

With the addition of the brief details presented below these facts are equally referable to all our species.

L. nitida Le Conte. This species is rather later in appearing than *L. anxia*, and seldom leaves the vicinity of its breeding grounds which are described above. In feeding, it seems to have a preference for aspen poplar, though it has also been found attacking elm. Eggs are prevalent in July,

and from then larvæ commence to appear late in the month and continue to do so throughout August. In the years the larvæ turn to pupæ, these latter are numerous by July 13th, and have developed into beetles between August 1st to September 3rd.

L. drakii Kirby. Our largest kind. Beetles appear slightly later than *L. rugosa*, and have reached the height of their flight at the time when the oak trees are leafing out. Their chief food consists of aspen poplar and oak. Eggs newly laid were discovered on June 23rd, from which young grubs continued to hatch from July 11th to September 5th. Pupæ are numerous by July 15th, and have been taken in the field as late as September 15th. Fully developed beetles appear in early August, though the majority do not develop until late in the month.

L. rugosa Melsh. By far the most abundant species on sandy soils. Beetles emerge soon after the trees come into leaf. They are general feeders, and have been taken from the following trees or shrubs: apple, plum, cherry (wild), thorn, rose, elm, maple, oak, and aspen poplar, the last named being most frequently attacked and the first but rarely.

Large numbers of eggs were collected in the field. They were found at depths varying from one to seven inches, and are plentiful in the soil from the third week in June until August. Larvæ commence to appear in mid-July and continue to do so until September. Most examples, however, emerge from the eggs between July 20th and August 8th. Prepupal conditions commence about July 10th, from which true pupæ are formed some eight days later. These have transformed into beetles about the middle of August. There is, however, considerable variation in the various developments.

WINTER HABITS OF LARVÆ

All White Grubs winter some distance beneath the surface, the depth at which they do so varying with the

different species; thus, the average depth at which the larva of *L. anxia* hibernates is forty-four inches in dryish woods and from fourteen to twenty-five inches in wet situations. The average depth of *L. nitida* is thirty-four inches, *L. rugosa* seventy-four inches, and *L. drakii* about forty inches. But few examples of this last have been located in their winter homes, consequently there is some doubt as to the exact depth at which these latter grubs hibernate. With those species which are found in or around woods or bushes, the falling leaves and drifting snow naturally protects them from frost. In the more open parts, such as those inhabited by *L. rugosa*, there is no such protection, hence we might expect, as is actually the case, that there would be a greater penetration into the soil to escape the cold.



MAY BEETLE, OR, JUNE BUG, THE ADULT OF THE WHITE GRUB. (After Gibson)

WINTER HABITS OF BEETLES

The fact that *Lachnosterna* larvæ burrow downwards in winter time is well known. It has not hitherto been recorded that some of the beetles do likewise, though it is, nevertheless, a fact. Of our four species, *L. anxia* and *L. drakii* remain in the pupal chamber, or very rarely burrow down a short distance. *L. nitida* usually moves slightly below its pupal cell, and is found at a depth of approximately six inches, with odd ones going down to as far as one foot. *L. rugosa*, however, is quite unlike the other three species, and has a marked downward movement, which commences soon after the beetles attain maturity, that is to say, about September 1st. From this time, the

beetles make their way rapidly downwards, and at the approach of winter average twenty-nine and a half inches below the surface, with a minimum depth of sixteen inches and a maximum of forty-seven inches. Specimens dug up and placed again in the soil burrowed to an average depth of twenty inches in forty-eight hours.



PUPA OF MAY BEETLE. (Original)

It is interesting to note here that allied genera have also developed this habit. For instance, the adults of *Diploptaxis obscura* Lec., a prairie species, have been found in Manitoba at a depth of from twenty-four to thirty-five inches below the surface. *Serica serica* Ill., a wood-loving insect, does not burrow downward, but

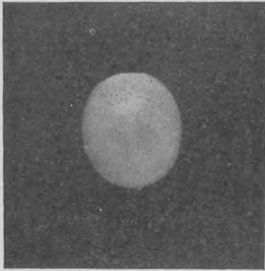


WHITE GRUB FEEDING ON ROOTS OF GRASSES. (After Gibson)

the larvæ do. Adults of *Dichelonychia subvittata* Lec. have been located at depths of fifteen inches in the soil.

All of our *Lachnosterna* beetles work upwards ahead of the larvæ.

This is doubtless due to their being less deep in the soil, and in consequence feeling the effects of the spring thaws sooner. On reaching the surface they do not necessarily emerge, but may remain among the leaves or earth close to the surface ready to take advantage of the first really warm evenings when they arise and fly to the trees to feed.



EGG OF MAY BEETLE. (Original)

METHODS OF CONTROL

Methods recommended for the suppression of White Grubs are based entirely upon a knowledge of the life-habits of the insects and those of their natural enemies. The following facts have been of particular importance in enabling us to arrive at conclusions concerning the more practical means of controlling White Grubs in Manitoba.

1. The grubs are below the plough line from October 7th to May 14th.

2. The beetles of *L. rugosa* are below the plough line from September 1st to May 1st.

3. Eggs are most prevalent in the soil between June 12th and July 24th, and nearly always occur in soil upon which vegetation is growing, especially grasses.

4. The prepupal and pupal stages occur between June 10th and August 15th.

5. The average depth at which all stages of these insects are found in summer is four inches.

6. Birds are most persistent followers of the plough during their breeding season or while migrating; gulls and terns from May 16th to June 22nd,

and for a short time late in July; crows and blackbirds, including grackles, from the time grubs appear in May until July 1st.

From the foregoing we reach the conclusion that to attain the best possible results under conditions existing in Manitoba, ploughing should be done between May 14th and July 1st, and at an average depth of five inches. The idea is, of course, to turn up as many grubs, eggs, or pupæ as possible, a majority of which will, in all probability, be picked up by birds. Many eggs will be destroyed by the plough alone, but it is advisable to harrow as soon as possible after ploughing, as by this means numerous egg cells will be broken, causing a large percentage of deaths among the eggs and newly-hatched young, besides exposing them to attack by birds. Exposed pupæ will also be destroyed by this method.

So far as the interests of farming is concerned, it will be observed that the above recommendations do not in any way clash with the best cultural methods. There is good reason for believing, too, that they will prove of value in the destruction of wireworms.

With reference to the large part birds are expected to play in this work, it may be claimed that birds are not always present in sufficient numbers, and that their capacity is, after all, limited. Granting this to be true in certain districts, we must remember that White Grubs are only found within comparatively close range of trees, and that their principal habitats coincide with the haunts of crows, the most persistent of all plough followers. Thus, if there are no crows present the farmer and sportsman are probably largely to blame, and the question then resolves itself into the economic one as to which does most harm, the crows or the White Grubs. We do not think there can be much doubt on this point in grub-infested localities. The writer has personally seen fully ninety per cent. of White Grubs

exposed picked up by crows when he was himself the ploughman.

Blackbirds are more dependant upon water than crows, hence are not so evenly distributed, but when present prove very efficient grub destroyers. Cow birds (*Molothrus ater*) are also extremely useful in this respect, and probably largely compensate for their parasitic habits by this means.

Fall ploughing in Manitoba, while accounting for a few pupæ in September, is not a practical means of destroying White Grubs. Birds at that time have congregated into flocks preparatory to migrating southward, and are then more inhabitants of grain fields. Thus, the grubs readily make their way into the ground again. After October 7th, most of the grubs have burrowed down below the frost line; they are also out of reach in April and usually in early May.

CROPS MOST SUITABLE FOR SOWING ON INFESTED LANDS

Grass lands are especially attractive to June beetles for egg-laying purposes, and should there be any of these insects in the neighbourhood they are sure to be found breeding in such places. This also applies with equal force to wireworms, and only in a slightly less degree to grass-stem maggots. It is a misfortune that one of our most useful and widely grown grasses in Manitoba (western rye grass) is specially attractive to all of these insects, and that in White Grub areas it suffers very severely from their attack. Fortunately, this drawback does not apply to anything like the same extent where brome grass is concerned. The farmer must suit his own convenience as to sowing these grasses, taking into consideration the fact that rye grass is especially attractive to insect pests while brome grass is not. This latter, however, has the misfortune of being difficult to eradicate.

Grass lands, as was pointed out

above, should be ploughed not later than July 1st to destroy White Grubs. Wheat should not be sown upon such land if avoidable, but preference may be given to winter rye, the next cereal in resisting power being spring rye, and after this oats. Usually a slightly thicker seeding than usual is advisable on newly-ploughed grass lands.

NATURAL ENEMIES OF WHITE GRUBS

While the birds mentioned previously might rightly be claimed as natural enemies of these insects, the above heading is more strictly referable to those animals which habitually live upon them without availing themselves of the aid supplied through man by means of the plough or some other cultural implement.

SKUNKS. These animals have been so misunderstood and their powers in other directions so exaggerated that the average farmer would probably be the last to rate them as his friends, though in reality he has few more useful ones among the wild animals. Should there be a skunk present the farmer may soon learn whether his fields are infested with white grubs through the many small holes which the skunk has made in digging them out. As this animal locates its food by scent, it is able to ascertain the presence of grubs without seeing them, and thus becomes extremely useful as a means of their destruction. In pointing out the value of skunks as destroyers of noxious insects we must not, however, forget that they also occasionally destroy hens eggs and poultry, though the small losses occasioned in this way are not to be compared with the benefits described above.

BIRDS. Robins are eager seekers after White Grubs, and have been known to frequent infested fields for weeks. Crows, apart from their habit of following the plough, are also very useful as grub searchers; the same may be said of flickers.

There are many other animals that eat White Grubs, or the June beetles

to which they develop, such as badgers, shrews, and even field mice.

INSECT AND OTHER INVERTEBRATE ENEMIES OF WHITE GRUBS

Parasites undoubtedly play an important part in reducing our farm pests to normal numbers, and in this respect they are equally effective in controlling White Grubs. Of the more important parasites reared from these latter during the last four years in Manitoba the following seem worthy of record.

TACHINIDAE. The species *Cryptomeigenia theutis* Walk. attacks the beetles, from two to nine puparia having been found in single individuals; about fifty per cent. of these beetles were killed by this parasite in 1914. *Microphthalma disjuncta* Wied. a common fly parasite in White Grubs and allied genera.

DEXIDAE. *Ptilodexia abdominalis*

Desv. and *P. tibialis* Desv. In larvæ, the former rare and the latter numerous. *Myiocera cremiodes* Walk. (?) has also been found in grubs.

MITES. *Tyroglyphus heteromorphus* Felt and others have caused the death of many White Grubs.

HAIR WORMS. *Mermithidæ*, long thread-like animals which live within the bodies of White Grubs and emerge after killing them. These have been responsible for about an eight per cent. death rate during the years covered by this investigation.

Fungous and other diseases have also caused many deaths, and seem to play an important part in White Grub reduction.

Mention may also be made of species of *Tiphia* and *Elis*, so useful in other parts of North America. Their appearance among *Lachnosteria* in Manitoba has, however, been seldom observed.